The Challenge of Astrometric Planet Searches: How to Select Proper Target Stars

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Precise astrometry is a powerful tool to detect and characterize extrasolar planets, very complementary to radial velocity surveys. In particular, the radial velocity method is restricted to certain types of stars and leaves the inclination angle of the orbit ($\sin i$) undetermined, thus providing only a lower limit to the mass of the planets. Astrometry has a different detection bias, favoring planets in large orbits versus the short-period orbits preferentially detected by the radial-velocity technique. Moreover, astrometry measures two components (right ascension and declination) of the stellar reflex motion versus the single radial component that is observable spectroscopically. To play a significant role, an astrometric accuracy of order $10\,\mu$arcsec is needed, which is beyond the performance of current instrumentation (including HST). However, differential astrometry relies on phase reference stars. Target and reference star pairs have to fulfill tight requirements on separation, brightness, distance, physical stellar parameters, and, in particular, on astrometric stability. In preparation of a ground-based astrometric planet search program with PRIMA at the ESO-VLTI, we systematically investigate the effect of various astrophysical factors that potentially affect the detection of an astrometric signal due to an orbiting planet and explore the detection domain for this method. Some of our results may also be applicable for other (e.g., space-based) astrometric planet searches like the SIM program.